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L. J. BARTON

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PROCESS FOR MAKING GRINDING BALLS

Filed Nov. 21, 1927

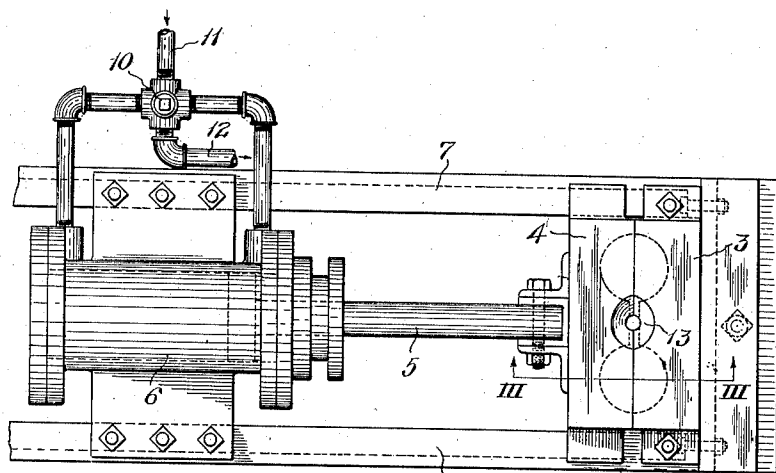


FIG. 1.

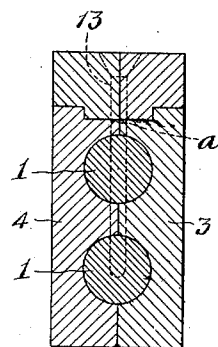


FIG. 3

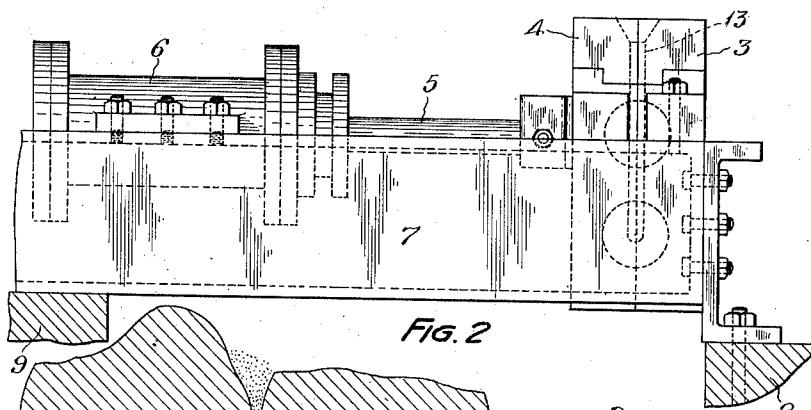


FIG. 2

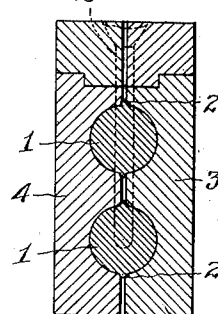


FIG. 4

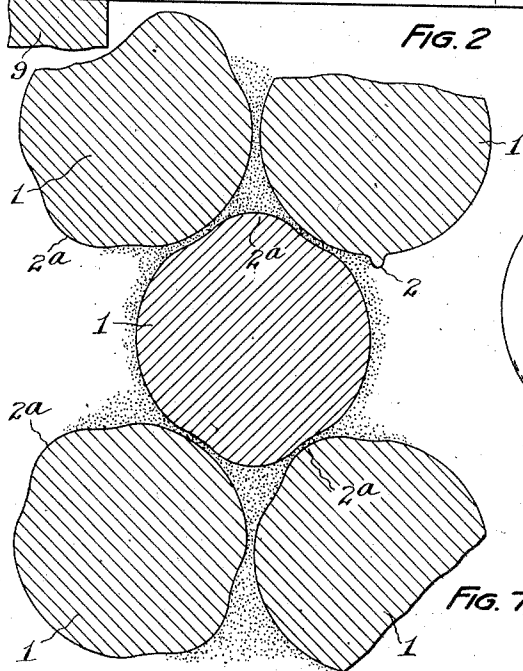


FIG. 7

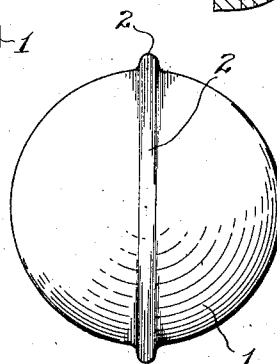


FIG. 6

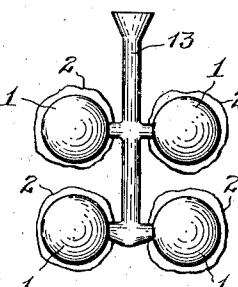


FIG. 5

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PROCESS FOR MAKING GRINDING BALLS

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My invention relates to grinding balls and to a process of making such grinding balls. More specifically it relates to a means of making cast grinding balls conveniently of a shape which will be particularly adaptable to grinding purposes by reason of their greater abrasive surface. It also relates to suitable permanent molds whereby such castings are easily and quickly made.

Grinding balls of this type are adapted to be used in any usual type of ball mill and their shape offers a greater surface or impingement of other similar balls, producing a more effective abrasive surface and a resulting decrease in the consumption of grinding balls per ton of metal ground or pulverized.

While in the annexed drawings and following description only one particular form and use of my invention is described and illustrated, other mechanical equivalents and methods by which the same results may be obtained are within the contemplation of my invention.

In said annexed drawings:

Figure 1 shows a plan view of the apparatus used to manufacture the improved grinding ball;

Figure 2 is a side elevation of the apparatus showing the location and relationship of the parts of the casting mold; the cavities for castings and gate being shown in dotted lines;

Figure 3 is a cross section through the mold taken on line III—III of Figure 1, this view, however, showing the mold partly filled with metal and the two halves of the mold tight together;

Figure 4 is a view similar to Figure 3, but showing the mold completely filled with metal and the two halves of the mold slightly separated;

Figure 5 shows the casting nucleus as removed from the mold, including the balls, pouring gates and fin;

Figure 6 is an elevation of a grinding ball which is ready for use in the mill, showing the peripheral fin; and

Figure 7, is a sectional view of the improved grinding balls operating in a mill after some of the balls are worn.

Referring to the same elements by the same ordinals throughout the several views, I designate a spheroidal grinding ball by the numeral 1 having its largest circumference in the form of a peripheral fin 2, said ball being formed in one of the sections of the cavities formed by the parts 3 and 4 of a permanent iron mold.

One half of a permanent iron mold is fastened to the frame 7 supported on the bases 8 and 9. The other half is bolted to the end of a piston rod 5 operating in the cylinder 6; the latter being actuated by air or water through the four way valve 10 connecting the supply and discharge ducts 11 and 12. By means of the valve 10 the piston and movable half 4 of the mold are caused to approach or recede from the fixed half 3 of the mold.

The mold may contain any number of cavities for the formation of grinding balls which will be filled through a common pouring gate 13. When the metal is poured, the halves of the mold are held tight together by the pressure of the fluid on the piston. This fluid pressure is so regulated that when the level of the metal in the mold reaches the height *a* as shown in Figure 3 the hydraulic head of the liquid metal in the mold is sufficient to counter balance the fluid pressure on the piston and the two halves of the mold. This separation of the two halves of the mold allows a small portion of the metal to run out between the mold halves. The metal mold quickly chills this metal, causing it to solidify in the shape of a fin.

The thickness of this fin is controlled by the distance which the mold halves are allowed to separate. This distance is controlled by the pressure exerted by the piston on the mold. The pressure exerted by the piston depends upon the size and number of balls in a mold as well as the weight and amount of metal poured therein.

After the ball nucleus, which consists of the balls, pouring gates and the fins, is solidified, the mold is opened by reversing the valve, and the entire nucleus is knocked from the mold. When the nucleus is cold the balls are broken from the gates and placed in an ordinary tumbling barrel where they are

tumbled for five or ten minutes. The latter process breaks away the unnecessary part of the fin 2, leaving the rounded portion which is desired as shown in Figure 6.

5 Balls made in this manner acquire their greatest advantage after they are slightly worn, the wearing of these balls taking place as indicated in Figure 7. The hard fin 2 resists wear around its periphery to a greater
10 degree than the balance of the surface of the ball, resulting in the formation of a wide convex rim 2A around the ball. The surface adjacent this rim forms a flat or concave area which permits a greater area of contact be-
15 tween this area and contacting balls. This permits a larger quantity of the material to be pulverized to collect between adjacent balls, resulting in a greater pulverizing action of the balls.

20 Any type of metal now used for such purposes may be used in the manufacture of this improved ball, including steel, alloy steels, white or mottled cast iron and malleable iron. I have found that for pulverizing copper ore
25 steel balls made in this manner are superior to round forged chrome steel balls. The accompanying drawings illustrate the best mode in which I have contemplated applying the principles herein described in such man-
30 ner as to distinguish it from other inventions.

What I claim is:

1. The method of casting metal grinding balls which consists in fastening rigidly one-half of a permanent mold having one or
35 more spherical matrices; in attaching the other half of said mold to adjustable pressure means; in pouring an excess of molten metal into said mold when the halves are tight together; and in releasing the pressure between
40 the mold halves a determined amount, allowing the pressure of the metal to separate and the excess molten metal to flow between said mold sections thereby forming a flange circumventing the resulting spheroid and forming
45 its maximum circumference.

2. The method of forming a spheroidal, cast metal grinding ball with a rounded flange forming its maximum circumference, which consists in filling the matrix of a
50 spherical mold with an excess of molten metal and allowing the mold sections to separate a determined amount under the pressure of the metal and the excess molten metal to spread therein until chilled.

55 Signed by me this 26th day of September, 1927.

LARRY J. BARTON.